COMPUTER MEDIATED COMPRESSION TECHNOLOGY TO COMBAT SENSORY OVERLOAD

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Background Information

The UMN Wearable Technology Lab (WTL) works to integrate a variety of technologies into everyday clothing, allowing for an improved user experience by providing wider levels of comfort ("Wearable Technology Lab: College of Design University of Minnesota"). Computer-mediated compression technology provides the ability to create controllable compression on a user's body discreetly and remotely using wirelessly controllable soft robotic systems (Wtl.design.umn.edu). This project worked with Professors Brad Holschuh and Linsey Griffin by studying the use of on-body stimulation to support children with autism / sensory processing disorder (SPD) who typically experience sensory overload as a consequence of their daily activities (Duvall, Schleif, Dunne, & Holschuh, 2019).

SENSORY OVERLOAD

Sensory overload occurs when any of the senses becomes "overwhelmed." The results of this can be debilitating to those who experience it, ranging from discomfort and irritability, to extreme anxiety ("Sensory overload: Symptoms, causes, and treatment"). This study focused on how the sense of touch could be adjusted with location, duration, magnitude, and the rate of compression, to help calm an individual experiencing sensory overload.

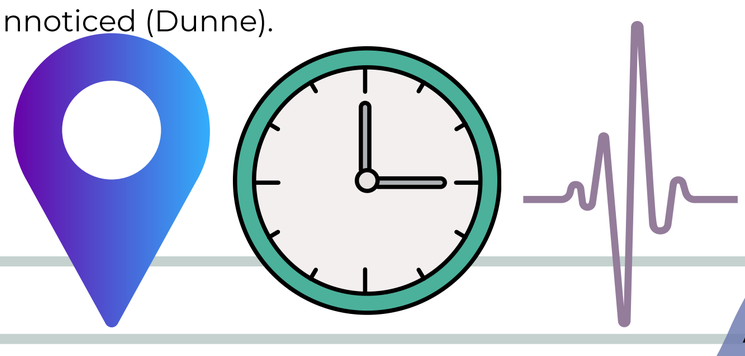
(Sensory Overload)

Compression technology can be adjusted to stimulate different locations of the body, for different durations, and at different magnitudes through the use of shape memory alloys, or SMAs. Sensory overload becomes difficult as it is a very subjective experience. SMAs require a source of heat to constrict, and are generally heat set at around 450 degrees celsius (Duvall). However, many have stated that after long durations, the heat becomes irritating (Granberry). Something like this, that may be a slight annoyance to a neurotypical individual, may be significantly more problematic to one who experiences SPD. Moreover, long term durations of the tight compression may become uncomfortable, or may even become adapted to and unnoticed (Dunne).

USER NEEDS

What do users prefer in a compression garment?

GARMENT RESEARCH



Location on the body

SMAs will be placed over shoulders, down the front and back, as well as on the sides to work for both men and women (Foo).

Duration

In previous studies, users noted discomfort around the 8.5 minute mark. This is partially attributed to the increasing temperature of the SMAs (Foo). Moreover, users may become desensitized to the garment with constant compression (Dunne). In a previous study done on focused attention, rhythmic pressure was shown to keep the user's focus on the garment (Foo).

Magnitude

Women enjoy more pressure in the shoulders, with less in the chest, and this is inverted for men. Overall, compression on the arms was viewed as uncomfortable and tighter compression in the lower back was more enjoyable (Foo).

The final garment

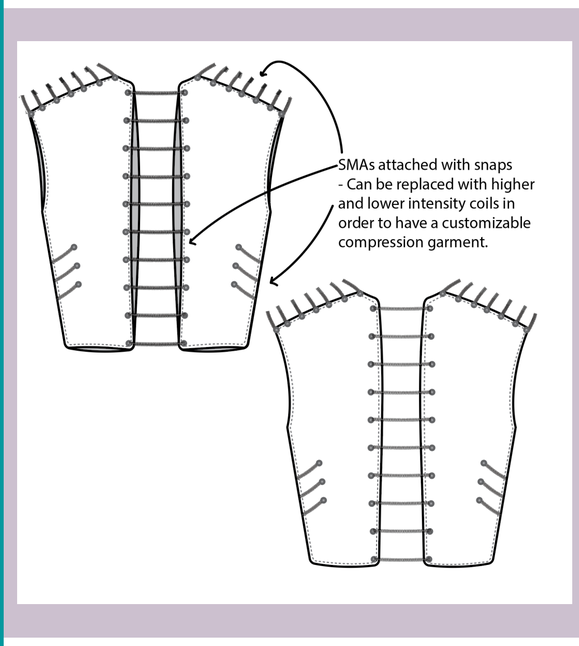
Autism and sensory processing disorder do not have one right answer or solution. However, there are some generalizations that can be made in order to create a proposed garment. Those who become overstimulated, may experience panic attacks. Generally, the peak of a panic attack is around the 10 minute mark (Melinda). By lowering the heat threshold of the SMAs, the garment may be able to be worn for a long enough duration that could be beneficial to an individual who becomes overstimulated. Moreover, the garment would also need to induce rhythmic pressure in order to draw the users attention towards the compression, rather than external stimuli (Foo). Inducing rhythmic pressure and lowering the heat threshold go hand in hand. The SMAs compress when an external heat source is added to the garment, and relax by being mechanically reset (Foo). By using a moderate stretch fabric, the physical garment would have enough tension to pull the SMAs back to their relaxed state when the heat source is removed. The ability to turn on and off the heat source also reduces the temperature created by the garment. Moreover, the coils would be wrapped in a braided sheath to reduce direct heat against the skin. Because men and women experience compression comfort in different locations and magnitudes, the SMAs are attached with snaps and can easily be removed and replaced with higher and lower intensity SMAs (Granberry).

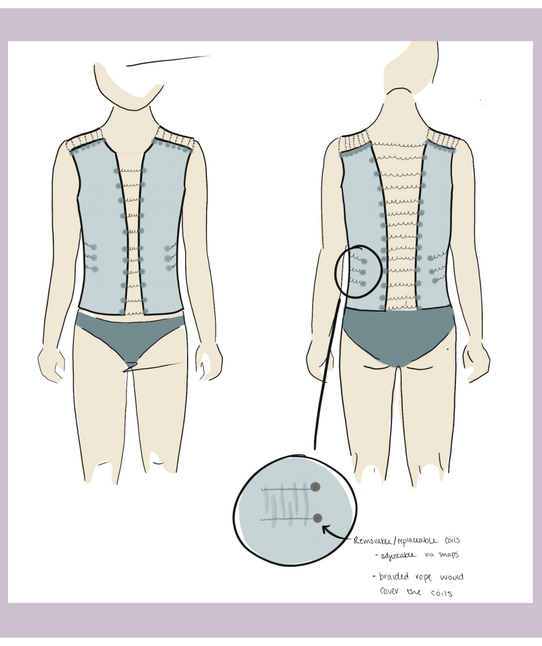
CONCLUSION

Lessons Learned and Next Steps

Overstimulation as a result of Autism or Sensory Preceding Disorder does not have a "one size fits all" solution. Any compression garment needs to be adjustable to fit a variety of user needs. Moreover, all of the research done has been theorized through the use of a variety of other studies, and based off of proposed user needs. However, next steps would require the construction of this garment in a variety of sizes and for the effectiveness to be tested. Another UROP project may need to be conducted to create physical prototypes, as well as to test the garment's effectiveness of the user group it was originally designed for.

Proposed Design





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